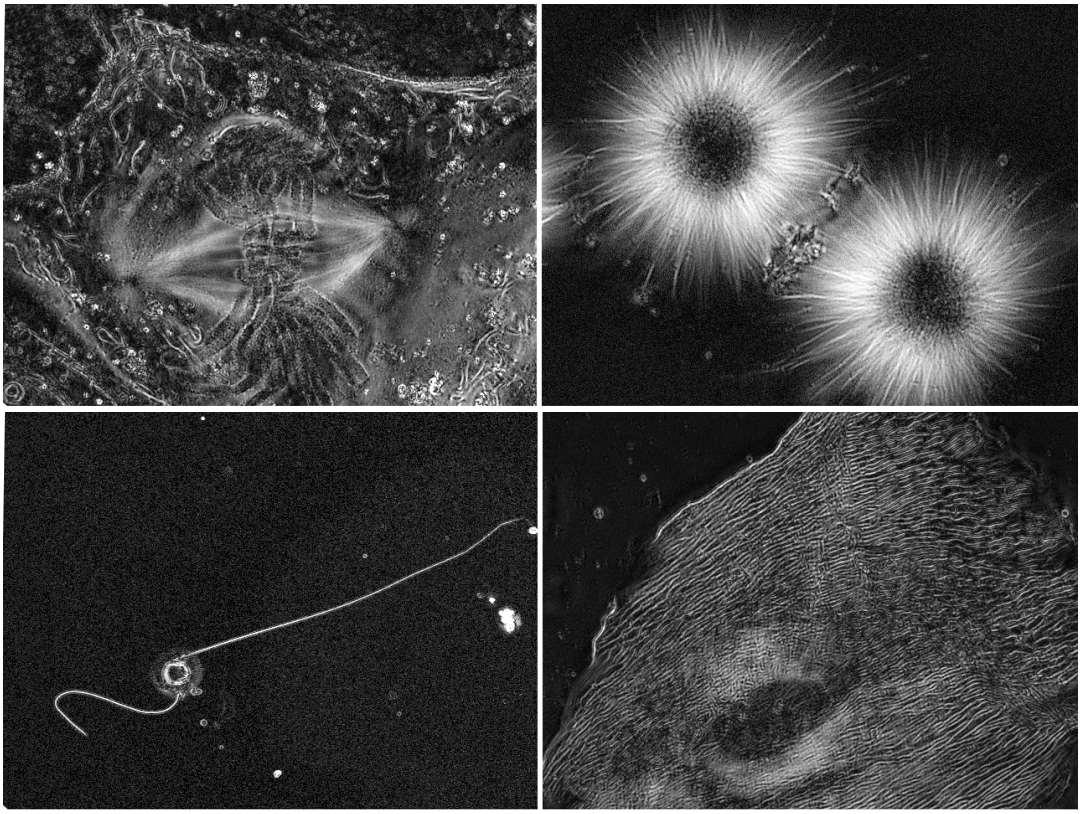
Biology in pictures

Polarized views



One can almost feel the strain as a newt lung epithelial cell (top left) undergoes mitosis. The white spindle fibers anchor the chromosomes (visible in outline) between the spindle poles, while kinetochore microtubule fibers connect each chromatid at its centromere to one of the mitotic poles. Elongated mitochondria, long stress fibers and small, spherical organelles can also be seen surrounding the spindle.

This detailed image of the dynamic architecture of a living cell was obtained using a new, improved polarization microscope, the Pol-Scope, developed using a combination of electro-optical devices, polarization algorithms and digital image processing.

Polarization microscopy uses the birefringence (intrinsic optical properties) of individual structures to create image contrast, which means that living cells can be viewed without staining or labelling, often in native environmental conditions. Specific structures such as membranes and filaments are highlighted because of their natural birefringence.

Images can also be taken at one-second intervals, to create time-lapse sequences of, for example, mitosis.

In the mitotic spindle from a fertilized sea urchin egg (top right), microtubule bundles radiate out from two black centrosomes, and chromosomes are visible between the two asters. (Reproduced from *Nature* with permission.)

The head of a sperm from the horse shoe crab (bottom left) appears suspended between its S-shaped tail, made up of parallel microtubules, and the long straight acrosomal process, made up of actin, which has been discharged from the head after an acrosomal reaction. (*Biological Bulletin*, in press.) The fine ridges standing out clearly on the surface of a human cheek cell are shown at bottom right.

The photographs were kindly provided by Rudolf Oldenbourg, Marine Biological Laboratory, Woods Hole, Massachusetts 02543, USA. (First three images as a result of collaborations with: P. Tran and E.D. Salmon; J. Murray; K. Katoh, K. Yamada and F. Oosawa, respectively) For details see R. Oldenbourg, *Nature* 1996, **381:**811–812.